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(54) **WHEEL END ASSEMBLY HAVING A COMPRESSION RING AND METHOD OF ASSEMBLY**

RADENDANORDNUNG MIT EINEM KOMPRESSIONSRING UND VERFAHREN ZUR MONTAGE

ENSEMBLE D'EXTRÉMITÉ DE ROUE AYANT UNE BAGUE DE COMPRESSION ET PROCÉDÉ D'ASSEMBLAGE

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Description

TECHNICAL FIELD

[0001] This disclosure relates to a wheel end assembly having a compression ring that may be disposed between a hub and a steering knuckle.

BACKGROUND

[0002] A wheel end assembly is disclosed in United States patent application serial number 15/346,792, filed November 9, 2016. A wheel end assembly according to the preamble of claim 1 is disclosed in WO 2013/047695 A1, a further wheel end assembly is disclosed in JP 2014 013073 A.

SUMMARY

[0003] In at least one approach, a wheel end assembly is provided. The wheel end assembly includes a steering knuckle, a hub, a seal assembly, and a compression ring. The steering knuckle has a spindle and an opening that extends around the spindle. The hub is rotatable about an axis with respect to the spindle. The seal assembly is at least partially disposed in the opening and extends from the spindle to the hub. The seal assembly has an outer seal case that is disposed on the hub and an inner seal case that is disposed on the spindle. The compression ring is disposed on the hub and is at least partially disposed in the opening. The compression ring exerts a radial compressive force on the hub in a direction that extends toward the seal assembly and the axis to inhibit the outer seal case from moving with respect to the hub.

[0004] In at least one approach, a method for assembling a wheel end assembly is provided. The method includes heating a compression ring to expand the compression ring. The method further includes positioning the compression ring with respect to a hub such that the hub is received in the compression ring. The method further includes cooling the compression ring so that the compression ring exerts a radially inward force on the hub.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

Figure 1 is a perspective view of a wheel end assembly.

Figure 2 is an exploded view of the wheel end assembly.

Figure 3 is a section view of the wheel end assembly along section line 3-3 with the addition of a wheel that is mounted on a hub and showing a compression ring.

Figure 4 is a magnified view of a portion of the wheel end assembly shown in Figure 3.

Figure 5 is a section view of the compression ring of Figure 4.

Figure 6 is a perspective view of an example of a steering knuckle that may be provided with the wheel end assembly.

Figure 7 is a magnified view of a portion of a wheel end assembly having another compression ring.

Figure 8 is a section view of the compression ring of Figure 7.

Figure 9 is a section view of a wheel end assembly showing the compression ring of Figure 7.

DETAILED DESCRIPTION

[0006] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

[0007] Referring to Figure 1, an example of a wheel end assembly 10 is shown. The wheel end assembly 10 may be provided with a motor vehicle like a truck, bus, farm equipment, military transport or weaponry vehicle, or cargo loading equipment for land, air, or marine vessels or a trailer that may be provided with a motor vehicle.

[0008] The wheel end assembly 10 may be part of a drive axle or a non-drive axle. A drive axle may receive torque from a power source, such as an internal combustion engine or electric motor. In a drive axle configuration, an axle shaft may transmit torque to the wheel end assembly 10 to rotate a wheel that may be mounted on the wheel end assembly 10. For instance, the axle shaft may be operatively connected at a first end to a vehicle drivetrain component, like a differential or input shaft, and may be coupled to the wheel end assembly 10 at a second end. The axle shaft may be omitted in a non-drive axle configuration.

[0009] Referring to Figures 1 and 2, the wheel end assembly 10 may facilitate mounting and rotation of a vehicle wheel. The wheel end assembly 10 may include a steering knuckle 20, a hub 22, a hub cap 24, a first wheel bearing 26, a second wheel bearing 28, a seal assembly 30, a compression ring 32, and a brake friction member 34.

[0010] Referring to Figures 2 and 3, the steering knuck-

le 20 may be part of a steering system that may be used to steer or change the direction of the vehicle. The steering knuckle 20 may be pivotally disposed on a support member, such as an axle assembly or a vehicle suspension system. In at least one configuration, the steering knuckle 20 may include a steering knuckle body 40 and a spindle 42.

[0011] Referring to Figures 2, 3 and 5, the steering knuckle body 40 may facilitate mounting of various components to the steering knuckle 20. In at least one configuration, the steering knuckle body 40 may include a first arm 50, a second arm 52, an outboard side 54, an inboard side 56, an inner surface 58, a notch 60, and one or more brake mounts 62.

[0012] The first arm 50 may be disposed near the top of the steering knuckle body 40 and may extend away from the outboard side 54. The first arm 50 may include a kingpin hole 70 that may receive a kingpin that may couple the steering knuckle 20 to another vehicle component, such as an axle beam or linkage. As such, the steering knuckle 20 may pivot or rotate about the kingpin and a kingpin axis 72. The kingpin hole 70 may be a through hole that may extend through the first arm 50.

[0013] The second arm 52 may be disposed near the bottom of the steering knuckle body 40 and may also extend away from the outboard side 54. The second arm 52 may also include a kingpin hole 70 that may receive the kingpin.

[0014] Referring to Figure 3, the outboard side 54 face toward the hub 22. As is best shown in Figures 2 and 5, a set of spindle mounting holes 74 may be provided in the outboard side 54. The spindle mounting holes 74 may be spaced apart from each other and may be radially disposed about an axis 80. Eight spindle mounting holes 74 are shown, but it is contemplated that a greater or lesser number may be provided. Moreover, the spindle mounting holes 74 may be omitted in various configurations, such as when the spindle 42 is integrally formed with the steering knuckle body 40. The spindle mounting holes 74 may extend from the outboard side 54 to the inboard side 56 and may be threaded.

[0015] The inboard side 56 may be disposed opposite the outboard side 54. As such, the inboard side 56 may face away from the hub 22. The inboard side 56 may engage the spindle 42 in one or more configurations.

[0016] Referring to Figures 2 and 3, the inner surface 58 may extend around the axis 80. In addition, the inner surface 58 may at least partially define an opening 82 that may extend through the steering knuckle body 40. For example, the opening 82 may extend from the outboard side 54 toward or to the inboard side 56. The inner surface 58 or portion thereof may be radially disposed with respect to the axis 80.

[0017] The notch 60 may be disposed below the axis 80 and may be located near or at the bottom of the inner surface 58 and the opening 82. For example, the notch 60 or portion thereof may be disposed directly below the axis 80 as is best shown in Figures 2 and 3. The notch 60 may extend from the outboard side 54 toward the inboard side 56. For instance, the notch 60 may extend in an axial direction or in a direction that extends parallel to the axis 80 from the outboard side 54 to a notch end surface 90 as is best shown in Figures 3 and 5. The notch end surface 90 may face toward the hub 22 and be axially positioned between the outboard side 54 in the inboard side 56. In addition, the notch end surface 90 may be disposed substantially perpendicular to the axis 80 in one or more configurations.

[0018] Referring to Figures 2 and 6, one or more brake mounts 62 may be provided to facilitate mounting of a brake assembly to the steering knuckle 20. For example, the brake mounts 62 may facilitate mounting of a brake caliper to the steering knuckle 20. The brake mounts 62 may extend from the outboard side 54 and may be spaced apart from the opening 82. In Figures 2 and 6, the brake mounts 62 are integrally formed with the steering knuckle body 40; however, it is contemplated that the brake mounts 62 may be provided as separate components that may be fastened to the steering knuckle body 40.

[0019] Referring to Figures 2 and 3, the spindle 42 may rotatably support the hub 22. For example, the spindle 42 may support the first wheel bearing 26 and the second wheel bearing 28, which in turn may support and facilitate rotation of the hub 22 and an associated vehicle wheel. In addition, the spindle 42 may extend along or may be centered about the axis 80.

[0020] The spindle 42 may be received in the opening 82. As such, the opening 82 may extend around a portion of the spindle 42. In addition, the spindle 42 may be fixedly positioned with respect to the steering knuckle body 40. Accordingly, the spindle 42 may not rotate about the axis 80 or rotate with respect to the steering knuckle body 40. For instance, the spindle 42 may be integrally formed with the steering knuckle body 40 or may be a separate component that may be fixedly mounted to the steering knuckle body 40. In the configuration shown, the spindle 42 is separate from the steering knuckle body 40 and may include a first spindle end surface 100, a second spindle end surface 102, a spindle mounting flange 104, an internal surface 106, and an external surface 108.

[0021] The first spindle end surface 100 may be disposed at a free end or distal end of the spindle 42. The first spindle end surface 100 may be disposed inside the hub 22 and may face toward the hub cap 24.

[0022] The second spindle end surface 102 may be disposed opposite the first spindle end surface 100. The second spindle end surface 102 may be disposed proximate or adjacent to the steering knuckle body 40 in configurations where the spindle 42 is a separate component from the steering knuckle body 40. For instance, the second spindle end surface 102 may be disposed near the inboard side 56 of the steering knuckle body 40. The second spindle end surface 102 may be omitted in configurations where the spindle 42 is integrally formed with the steering knuckle 20.

[0023] The spindle mounting flange 104 may extend in an axial direction from the second spindle end surface 102 toward the first spindle end surface 100. In addition, the spindle mounting flange 104 may extend outwardly away or radially away from the axis 80 and may facilitate mounting of the spindle 42 to the steering knuckle body 40. For example, the spindle mounting flange 104 may include a plurality of mounting flange holes 110 that may extend through the spindle mounting flange 104 as is best shown in Figure 2. The mounting flange holes 110 may be arranged around the axis 80 and may be aligned with corresponding spindle mounting holes 74. Each mounting flange hole 110 may receive a spindle mounting fastener 112, such as a bolt, that may couple the spindle 42 to the steering knuckle body 40. Each spindle mounting fastener 112 may be received in a corresponding spindle mounting hole 74 of the steering knuckle body 40.

[0024] Referring to Figures 2 and 3, the internal surface 106 may extend between the first spindle end surface 100 and the second spindle end surface 102. As is best shown in Figure 3, the internal surface 106 may at least partially define a spindle hole 114. The axle shaft, if provided, may extend through the spindle hole 114. The internal surface 106 and the spindle hole 114 may optionally be omitted in a non-drive axle configuration.

[0025] The external surface 108 may be disposed opposite the internal surface 106. The external surface 108 may support the first wheel bearing 26 and the second wheel bearing 28 as will be discussed in more detail below.

[0026] Referring to Figures 2 and 3, the hub 22 may be rotatably disposed on the spindle 42. As such, the hub 22 may be rotatable about the axis 80 with respect to the spindle 42. In a drive axle configuration, the hub 22 may be operatively connected to an axle shaft. In at least one configuration, the hub 22 may have a first end surface 120, a second end surface 122, a hub cavity 124, a first hub mounting flange 126, a second hub mounting flange 128, and a mounting ring 130.

[0027] The first end surface 120 may face toward and may engage the hub cap 24. As is best shown in Figure 2, the first end surface 120 may include a plurality of hub cap fastener holes 140. The hub cap fastener holes 140 may be arranged around the axis 80 and may receive a fastener 142, such as a mounting stud or a bolt, that may couple the hub cap 24 to the hub 22.

[0028] Referring to Figures 2 and 4, the second end surface 122 may be disposed opposite the first end surface 120. The second end surface 122 may face away from the hub cap 24 and may face toward the steering knuckle 20. As is best shown in Figure 4, the second end surface 122 may be received in the opening 82 of the steering knuckle body 40.

[0029] Referring to Figures 2 and 3, the hub cavity 124 may extend from the first end surface 120 to the second end surface 122. The hub cavity 124 may receive at least a portion of various components of the wheel end assembly 10, such as the spindle 42, first wheel bearing 26, and the second wheel bearing 28.

[0030] The first hub mounting flange 126 may be disposed near the first end surface 120. The first hub mounting flange 126 may extend away from the axis 80. For instance, the first hub mounting flange 126 may extend substantially perpendicular to the axis 80 in one or more configurations. The first hub mounting flange 126 may facilitate mounting of a wheel 150 that may support a tire. For example, the first hub mounting flange 126 may include a set of mounting lug fastener holes 152 that may each receive a wheel mounting lug 154. As is best shown in Figure 3, the wheel 150 may have a wheel mounting flange that may have a set of holes that may be aligned with the wheel mounting lugs 154. A lug nut 156 may be threaded onto each wheel mounting lug 154 to secure the wheel 150 to the hub 22.

[0031] Referring to Figures 2 and 3, the second hub mounting flange 128 may be located near the center of the hub 22. For instance, the second hub mounting flange 128 may be axially positioned between the first end surface 120 and the second end surface 122. The second hub mounting flange 128 may facilitate mounting of the brake friction member 34 of a brake subsystem. For example, the second hub mounting flange 128 may include a set of fastener holes 160 as is best shown in Figure 3. A fastener hole 160 may receive a brake friction member fastener 162, such as a mounting stud or bolt, that may facilitate mounting of the brake friction member 34 to the hub 22 such that the brake friction member 34 rotates with the hub 22.

[0032] Referring to Figures 2 and 4, the mounting ring 130 may be disposed at an end of the hub 22. For example, the mounting ring 130 may extend in an axial direction from the second end surface 122 toward the hub cap 24. Moreover, the second end surface 122 may define and may be referred to as an end surface of the mounting ring 130. The mounting ring 130 may extend around the axis 80 and may extend into the opening 82 of the steering knuckle body 40. In at least one configuration, the mounting ring 130 may have a step surface 170, a first outer surface 172, and a second outer surface 174.

[0033] Referring to Figure 4, the step surface 170 may be disposed outside of the opening 82 and may face away from the hub cap 24 and toward the steering knuckle 20. The step surface 170 may be disposed substantially perpendicular to the axis 80. In addition, the step surface 170 may be axially positioned between the second end surface 122 and the second hub mounting flange 128 as is best shown with reference to Figures 3 and 4. The step surface 170 may facilitate positioning of the compression ring 32 as will be discussed in more detail below.

[0034] The first outer surface 172 may extend from the step surface 170 to or toward the second end surface 122. The first outer surface 172 may extend continuously around the axis 80 and may be disposed at a substantially constant radial distance from the axis 80. The compres-

sion ring 32 may be disposed on the first outer surface 172 as will be discussed in more detail below.

[0035] The second outer surface 174 may extend from the second end surface 122 to or toward the first outer surface 172. As is best shown in Figure 4, the second outer surface 174 may be disposed opposite the seal assembly 30. The second outer surface 174 may extend continuously around the axis 80 and may be disposed a substantially constant radial distance from the axis 80. The second outer surface 174 may be disposed closer to the axis 80 than the first outer surface 172. The compression ring 32 may be spaced apart from and may not engage the second outer surface 174. It is also contemplated that the second outer surface 174 may be omitted, such as when the first outer surface 172 extends to the second end surface 122.

[0036] Referring to Figures 2 and 3, the first wheel bearing 26 may be disposed on the spindle 42 and may rotatably support the hub 22. For example, the first wheel bearing 26 may be disposed on and may extend around the external surface 108 of the spindle 42 and may be received in the hub cavity 124. The first wheel bearing 26 may be positioned closer to the first spindle end surface 100 than the second wheel bearing 28.

[0037] The first wheel bearing 26 may have any suitable configuration. For instance, the first wheel bearing 26 may include a plurality of rolling elements, such as balls or rollers, that may be disposed between an inner race and an outer race. The inner race may be disposed on and may extend around the external surface 108 of the spindle 42. The outer race may be disposed on the hub 22 and may extend around the inner race.

[0038] The retaining nut 180 may help secure the first wheel bearing 26. More specifically, the retaining nut 180 may inhibit or limit axial movement of the first wheel bearing 26 along the spindle 42 in a direction that extends toward the first spindle end surface 100. For example, the retaining nut 180 may receive and may mate with corresponding threads on the spindle 42. The retaining nut 180 may engage the inner race of the first wheel bearing 26 and may be tightened to exert a preload force on the first wheel bearing 26.

[0039] The second wheel bearing 28 may also be disposed on the spindle 42 and may rotatably support the hub 22. For example, the second wheel bearing 28 may be disposed on and may extend around the external surface 108 of the spindle 42 and may be received in the hub cavity 124. The second wheel bearing 28 may be positioned closer to the second spindle end surface 102 than the first wheel bearing 26. The second wheel bearing 28 may have any suitable configuration. For instance, the second wheel bearing 28 may include a plurality of rolling elements, such as balls or rollers, that may be disposed between an inner race and an outer race.

[0040] Referring to Figure 1, the brake friction member 34 may be part of a brake subsystem that may brake an associated wheel. The brake subsystem may have any suitable configuration. For instance, the brake subsystem may be configured as a friction brake, such as a disc brake or a drum brake. In Figure 1, a portion of the brake subsystem is shown that has a disc brake configuration. In such a configuration, the brake friction member 34 may be a brake rotor. The brake friction member 34 may be configured as a brake drum when the brake subsystem is configured as a drum brake. One or more brake pads may be actuated into engagement with the brake friction member 34 to slow rotation of the hub 22 and the wheel 150 about the axis 80.

[0041] Referring to Figures 2 and 3, the brake friction member 34 may be fixedly disposed on the hub 22 by way of the brake friction member fasteners 162. In at least one configuration, a washer 182 and a nut 184 may be disposed on the brake friction member fasteners 162 to secure the brake friction member 34. As is best shown in Figure 3, the brake friction member 34 may be axially positioned such that the brake friction member 34 extends around the hub 22 and may generally be positioned between the first wheel bearing 26 and the second wheel bearing 28.

[0042] Referring to Figures 2-4, the seal assembly 30 may be disposed between the hub 22 and the spindle 42. For example, the seal assembly 30 may extend continuously around the axis 80 and the spindle 42 and may extend from the spindle 42 to the hub 22. In addition, the seal assembly 30 may be axially positioned between the second wheel bearing 28 and the spindle 42. The seal assembly 30 may be completely or partially disposed inside the opening 82 of the steering knuckle body 40 and inside the hub cavity 124. The seal assembly 30 may help inhibit lubricant from exiting the hub cavity 124 between the spindle 42 and the hub 22. In addition, the seal assembly 30 may inhibit contaminants from entering the hub cavity 124.

[0043] In at least one approach, the seal assembly 30 may include at least one seal case 36 and a seal 38. More particularly, the seal assembly 30 may include an inner seal case 36a and an outer seal case 36b. The seal case 36 may position and hold the seal 38. The mounting bracket 25 may be fixedly disposed on the hub 22. As such, the seal case 36 may rotate with the hub 22 and with respect to the seal 38. The seal case 36 may be secured to the hub 22 in any suitable manner, such as through an interference fit engagement.

[0044] In at least one approach, the seal case 36 may be formed of a first material, and the hub 22 may be formed of a second material different than the first material. For example, the hub 22 may be formed of aluminum, and the seal case 36 may be formed of steel. As such, the seal case 36 and the hub 22 may have different coefficients of thermal expansion. More particularly, the hub 22 may have a thermal expansion coefficient greater than that of the seal case 36. For example, the seal case 36 may have a volumetric thermal expansion coefficient (α_V) in the range of approximately 33×10^{-6} K^{-1} to approximately 39×10^{-6} K^{-1} at 20°C. The hub 22 may have a volumetric thermal expansion coefficient (α_V) in the

range of approximately 68×10^{-6} K^{-1} to approximately 70×10^{-6} K^{-1} at 20°C. As such, the hub 22 may expand at a greater rate when exposed to elevated temperatures (e.g., 150°C or greater) at the wheel end assembly 10. The expansion of the hub 22 relative to the seal case 36 may deteriorate or diminish the fit between hub 22 and the seal case 36. A loose or otherwise ineffective fit between hub 22 and the seal case 36 may cause the hub 22 to rotate relative to the seal case 36, which may weaken or even destroy the structural integrity of the hub 22, the seal case 36, or both the hub 22 and the seal case 36.

[0045] To reduce or inhibit the degree of expansion of the hub 22, the hub 22 may be provided with a compression ring 32. The compression ring 32 may be disposed on the hub 22, for example, about the at the mounting ring 130, and may be at least partially disposed in the opening 82. For example, the compression ring 32 may be fixedly positioned with respect to the hub 22 such that the compression ring 32 and the hub 22 may rotate together about the axis 80 with respect to the steering knuckle 20. The compression ring 32 may be configured as a ring that may extend continuously around the hub 22 and the axis 80.

[0046] The compression ring 32 may be disposed on the hub 22 such that the compression ring 32 exerts a compressive force on the mounting ring 130; for example, a compressive force in the radial direction toward the axis 80. The compressive force may act on the entire outer circumference of the mounting ring 130 to urge the mounting ring 130 toward the axis 80.

[0047] As is best shown in Figures 4 and 5, the compression ring 32 may have a generally trapezoidal cross-section and may include a body 190 that may define (and may extend between) an inner surface 192 defining opposing ends, an outer surface 194 defining opposing ends, and opposing side surfaces 196 extending between the inner surface 192 and the outer surface 194.

[0048] The inner surface 192 may define an inner diameter of the compression ring 32. The inner diameter may be in the range, for example, of approximately 159 millimeters to approximately 160 millimeters. The inner surface 192 may be disposed on the mounting ring 130 of the hub 22. In addition, inner surface 192 may extend continuously around the mounting ring 130 and the axis 80. The inner surface 192 may be disposed on the first outer surface 172 and may be radially disposed with respect to the axis 80. The inner surface 192 may be spaced apart from and may not engage the second outer surface 174.

[0049] The outer surface 194 may define an outermost diameter of the compression ring 32. The outer diameter may be in the range, for example, of approximately 165 millimeters to approximately 166 millimeters. In at least one approach, the outer surface 194 may have a substantially planar cross section in a plane in which the axis is completely disposed. The outer surface 194 may have an axial length along the cross section greater than an axial length of the inner surface 192. For example, outer surface 194 may have an axial length along the cross section of approximately 17 millimeters, and the inner surface 192 may have an axial length of approximately 16 millimeters or less. The outer surface 194 may be parallel to the inner surface 192. The outer surface 194 may have a surface area (e.g., at a surface facing inner surface 58) greater than a surface area of the inner surface 192 (e.g., at a surface facing the first outer surface 172).

[0050] The opposing side surfaces 196 may extend at equal lengths between the inner surface 192 and the outer surface 194. In at least one approach, one side surface 196b may be received within the opening 82 of the steering knuckle body 40, and an opposing side surface 196a may not be received in the opening 82. In at least one approach, one side surface 196a may engage the hub 22. For example, one side surface 196a may extend along and may engage the step surface 170. As such, the step surface 170 may inhibit axial movement of the compression ring 32 in a direction that extends away from the steering knuckle body 40 and toward the hub cap 24. Moreover, an opposing side surface 196b may be spaced apart from the steering knuckle 20 and the hub 22. For instance, the opposing side surface 196b may be received in the opening 82 of the steering knuckle body 40 and may extend toward but may not engage the inner surface 58 of the steering knuckle body 40. As such, the opposing side surface 196b may not inhibit rotation of the hub 22 with respect to the steering knuckle 20,

[0051] The opposing side surfaces 196 may include connecting surfaces 200 and end surfaces 202. The angled connecting surfaces 200 may extend at an oblique angle relative to the inner surface 192 and the outer surface 194. In at least one approach, the compression ring 32 includes a first connecting surface 200 that extends from a first end of the inner surface 192 toward the outer surface 194. The first connecting surface 200 may have a substantially planar cross section in the plane and extends at an oblique angle relative to the inner surface 192. The compression ring 32 may further include a second connecting surface 200 that extends from a second end of the inner surface 192 toward the outer surface 194. The second connecting surface 200 may have a substantially planar cross section in the plane and extends at an oblique angle relative to the inner surface.

[0052] The orthogonal end surfaces 202 may extend at a generally orthogonal angle relative to the inner surface 192 and the top surface 196. In at least one approach, the compression ring 32 may include a first end surface 202 that extends from an end of the first connecting surface 200 to the outer surface 194. The first end surface 202 may engage the hub 22. The compression ring 32 may further include a second end surface 202 that extends from an end of the second connecting surface 200 to the outer surface 194. The second end surface 202 may be disposed in the opening 82.

[0053] Referring to Figure 7, another compression ring 210 is shown. The compression ring 210 may include a

body 212 that may define (and may extend between) an inner surface 214, an outer surface 216, and opposing side surfaces 218, 220. Side surface 218 may extend a height greater than a height of the step surface 170. Side surface 220 may extend a height less than a height of the step surface 170.

[0054] The inner surface 214 may be disposed on the mounting ring 130 of the hub 22. In addition, inner surface 214 may extend continuously around the mounting ring 130 and the axis 80. The inner surface 214 may be disposed on the first outer surface 172 and may be radially disposed with respect to the axis 80. The inner surface 214 may be spaced apart from and may not engage the second outer surface 174.

[0055] Referring to Figure 8, in at least one approach, a side wall (e.g., side wall 218) may form an inner connecting surface 222. The inner connecting surface 222 may be a feature such as a chamfer or fillet. The inner connecting surface 222 may extend approximately 45 degrees from the inner surface 214. The inner connecting surface 222 may space a portion of the body 212 from the step surface 170. In at least one approach, the inner connecting surface 222 is a planar surface. The inner connecting surface 222 may also, or instead, include a rounded surface having a curvature.

[0056] The body 212 may extend various lengths from the inner surface 214 along the cross-section of the compression ring 210. In this way, the outer surface 216 may define various top surfaces. For example, the body 212 may extend to a first perimeter surface 230 disposed a first height H1 from the inner surface 214, an intermediate outer surface 232 disposed a second height H2 from the inner surface 214, and a second perimeter surface 234 disposed a third height H3 from the inner surface 214. The first perimeter surface 230 may have an axial length along the cross-section of the compression ring 210 in the range of approximately 1 millimeter to approximately 2 millimeters. The second perimeter surface 234 may have an axial length along the cross-section of the compression ring 210 of approximately 2 millimeters.

[0057] One or more of the first perimeter surface 230, the intermediate outer surface 232, and the second perimeter surface 234 may extend parallel to the inner surface 214. In at least one approach, H1 may be greater than H2 and H3, and H3 may be greater than H2. The third height H3 may be, for example, half or less than half of the first height H1 (i.e., the first perimeter surface 230 may extend along a height that is twice as high, or more, from the inner surface 214 as the second perimeter surface 234). In at least one approach, H1 may be in the range of approximately 15 millimeters to approximately 16 millimeters. H2 may be approximately 2 millimeters. H3 may be in the range of approximately 5 millimeters to approximately 6 millimeters.

[0058] The outer surface 216 may further include a first outer connecting surface 236 and a second outer connecting surface 238. The first outer connecting surface 236 may extend, for example, between the first perimeter surface 230 and the intermediate outer surface 232. In this way, the first outer connecting surface 236 may have a variable height relative to the inner surface 214. The variable height may be in the range of H2 to H1. The second outer connecting surface 238 may extend, for example, between the intermediate outer surface 232 and the second perimeter surface 234. In this way, the second outer connecting surface 238 may also have a variable height relative to the inner surface 214. The variable height may be in the range of H2 to H3.

[0059] In at least one approach, the first outer connecting surface 236 is a planar surface. The first outer connecting surface 236 may also, or instead, include a rounded surface having a curvature. In at least one approach, the second outer connecting surface 238 is a planar surface. The second outer connecting surface 238 may also, or instead, include a rounded surface having a curvature.

[0060] In this way, the compression ring 210 may form a first peak at the first perimeter surface 230, a second peak at the second perimeter surface 234, and a valley at the intermediate outer surface 232. The first peak may block or inhibit contaminants from passing around the compression ring 210 to reach the seal assembly 30 or pass around the seal assembly 30 to contaminate the lubricant in the wheel end assembly 10, which may lead to wear and reduced component life. The contaminants may be collected in the valley.

[0061] Referring to Figure 9, axial positioning of the compression ring 210 with respect to the steering knuckle 20 is shown in more detail. In Figure 9, the inner surface 58 of the steering knuckle body 40 extends in an axial direction further toward the hub 22 above the axis 80 than below the axis 80. More specifically, the inner surface 58 may have a shorter axial length where the notch 60 is provided in the steering knuckle body 40 than an axial length where the notch 60 is not provided in the steering knuckle body 40. As such, the axial distance D_1 from the step surface 170 of the hub 22 to the notch end surface 90 may be greater than the axial distance D_2 from the step surface 170 of the hub 22 to the outboard side 54. As such, the first perimeter surface 230 of the compression ring 210 may also be disposed further from the notch end surface 90 than from the outboard side 54. Such a configuration may allow contaminants that are received in or captured by the valley cross-section of the compression ring 210 to more freely exit the wheel end assembly 10 via the notch 60. As such, the compression ring 210 may be "self-cleaning" as contaminants that are captured by the compression ring 210 may be released or flung off the compression ring 210 as the hub 22 rotates and may exit the opening 82 via the notch 60.

[0062] In at least one approach, the compression rings 32, 210 may be formed of a first material, and the hub 22 may be formed of a second material different than the first material. For example, the hub 22 may be formed of aluminum, and the compression rings 32, 210 may be formed of steel. As such, the compression rings 32, 210 and the hub 22 may have different coefficients of thermal

expansion. More particularly, the hub 22 may have a thermal expansion coefficient greater than that of the compression rings 32, 210. For example, the compression rings 32, 210 may have a volumetric thermal expansion coefficient (α_V) in the range of approximately 33×10^{-6} K^{-1} to approximately 39×10^{-6} K^{-1} at 20°C. The hub 22 may have a volumetric thermal expansion coefficient (α_V) in the range of approximately 68×10^{-6} K^{-1} to approximately 70×10^{-6} K^{-1} at 20°C.

[0063] As such, the compression rings 32, 210 may act to reduce or inhibit the degree of expansion of the hub 22 in the region of the mounting ring 130. For example, when the hub 22 is heated to a temperature (such as 150°C) that would induce expansion of the mounting ring 130 but not the compression rings 32, 210, the radial compressive forces exerted by the compression rings 32, 210 on the mounting ring 130 may reduce or inhibit the degree of expansion of the mounting ring 130 away from the axis 80 with respect to the spindle 42 to maintain an interference fit between the outer seal case 36b and the mounting ring 130.

[0064] In at least one approach, one or more seals (not shown) may be disposed on the compression ring 32 or the compression ring 210. For example, a seal may be disposed on the outer surface 194 of compression ring 32 to at least partially fill the radial gap between the outer surface 194 and the inner surface 58 of the steering knuckle body 40. The seal may extend continuously around the axis 80. The seal may be made of any suitable material, such as a polymeric or an elastomeric material like rubber. In this way, the seal may help block or inhibit contaminants, such as particulates like dirt and pebbles and/or liquids, from passing through the opening 82 or passing between the compression ring 32 and the inner surface 58 of the steering knuckle body 40. A seal may similarly be disposed on the outer surface 216 (e.g., at the second perimeter surface 234) of the compression ring 210.

[0065] A method for assembling a wheel end assembly may include heating a compression ring, such as compression ring 32 or the compression ring 210, to expand the compression ring. The compression ring may be heated, for example, at a temperature of 200 °C. The method may further include positioning the compression ring at an outer annular surface of a mounting ring of a hub. The method may further include positioning a seal assembly at an inner annular surface of the mounting ring. The compression ring may impart a radial compressive force on the mounting ring when the compression ring is cooled to a second temperature lower than the first temperature.

[0066] In at least one approach, the method may further include securing a steering knuckle to a spindle. The method may further include positioning the hub such that at least a portion of the compression ring is radially disposed between an annular surface of the spindle and an annular surface of the steering knuckle.

[0067] In at least one approach, a method for installing a compression ring is provided. The installation may be a retrofit installation. In this way, the method may include removing a hub from an axle spindle. The method may further include disposing the hub face such that a mounting ring is accessible (e.g., facing in an upward direction). In an optional approach, the method may include removing paint, dirt, or other substances from the mounting ring.

[0068] The method may include applying a continuous a bead of adhesive sealant (e.g., a 3 mm-wide bead) 360 degrees around the mounting ring.

[0069] The method may further include heating a hub compression ring, for example, in an oven. The compression ring may be heated to threshold temperature; for example, to approximately 204°C. Upon heating the compression ring to the threshold temperature, the method may further include removing the compression ring from the oven. The method may further include disposing the compression ring onto the mounting ring. The compression ring may be pressed down onto the mounting ring, for example, with hand force. In at least one approach, the compression ring is seated against the step surface of the hub (e.g., adjacent the mounting ring). The compression ring may impart a radial compressive force on the mounting ring when the compression ring cools to a temperature lower than the threshold temperature.

Claims

1. A wheel end assembly (10) comprising:

a steering knuckle (20) having a spindle (42) and an opening (82) that extends around the spindle (42);
a hub (22) that is rotatable about an axis (80) with respect to the spindle (42);
a seal assembly (30) that extends from the spindle (42) to the hub (22), the seal assembly (30) having an outer seal case (36b) that is disposed on the hub (22) and an inner seal case (36a) that is disposed on the spindle (42);
characterised in that the seal assembly (30) is at least partially disposed in the opening (82);
a compression ring (32, 210) that is disposed on the hub (22) and that is at least partially disposed in the opening (82), wherein the compression ring (32, 210) exerts a radial compressive force on the hub (22) in a direction that extends toward the seal assembly (30) and the axis (80) to inhibit the outer seal case (36b) from moving with respect to the hub (22).

2. The wheel end assembly (10) of claim 1 wherein the hub (22) has a mounting ring (130) upon which the seal assembly (30) and the compression ring (32, 210) are disposed, wherein the compression ring (32, 210) inhibits expansion of the mounting ring (130) away from the axis (80) with respect to the

spindle (42) to maintain an interference fit between the outer seal case (36b) and the mounting ring (130), preferably the compression ring (32, 210) and the outer seal case (36b) are disposed on opposite sides of the mounting ring (130).

3. The wheel end assembly (10) of any preceding claim wherein the hub (22) has a volumetric thermal expansion coefficient greater than a volumetric thermal expansion coefficient of the compression ring (32, 210).

4. The wheel end assembly (10) of any preceding claim wherein the compression ring (32) has an inner surface (192) disposed in engagement with the hub (22) and an outer surface (194) that is disposed opposite the inner surface (192) and that extends parallel to the inner surface (192), wherein the outer surface (194) extends from a first end of the compression ring (32) that engages the hub (22) to a second end of the compression ring (32) that is disposed opposite the first end.

5. The wheel end assembly (10) of claim 4 wherein the outer surface (194) has a substantially planar cross section in a plane in which the axis (80) is completely disposed.

6. The wheel end assembly (10) of claim 4 or claim 5 wherein the compression ring (32) includes a first connecting surface (200) that extends from a first end of the inner surface (192) toward the outer surface (194), wherein the first connecting surface (200) has a substantially planar cross section in the plane and extends at an oblique angle relative to the inner surface (192).

7. The wheel end assembly (10) of claim 6 wherein the compression ring (32) includes a first end surface (202) that extends from an end of the first connecting surface (200) to the outer surface (194), wherein the first end surface (202) engages the hub (22).

8. The wheel end assembly (10) of claim 6 or claim 7 wherein the compression ring (32) includes a second connecting surface (200) that extends from a second end of the inner surface (192) toward the outer surface (194), wherein the second connecting surface (200) has a substantially planar cross section in the plane and extends at an oblique angle relative to the inner surface (192), preferably the compression ring (32) includes a second end surface (202) that extends from an end of the second connecting surface (200) to the outer surface (194), wherein the second end surface (202) is disposed in the opening (82).

9. The wheel end assembly (10) of claim 1 wherein the compression ring (210) has an inner surface (214) disposed in engagement with the hub (22), an outer surface (232) that is disposed opposite the inner surface (214) and that extends parallel to the inner surface (214), an inner connecting surface (222) that extends from a first end of the inner surface (214), and a first outer connecting surface (236) that extends from an end of the outer surface (232) toward the hub (22), wherein the inner connecting surface (222) is disposed substantially parallel to the first outer connecting surface (236).

10. The wheel end assembly (10) of claim 9 wherein the compression ring (210) further comprises a first end surface (218) that extends from an end of the inner connecting surface (222) and engages the hub (22) and a first perimeter surface (230) that extends from the first end surface (218) to the first outer connecting surface (236), preferably the first perimeter surface (230) is disposed substantially parallel to the inner surface (214).

11. The wheel end assembly (10) of claim 10 wherein the compression ring (210) further comprises a second end surface (220) that extends from a second end of the inner surface (214), wherein the first end surface (218) has a greater radial length than the second end surface (220).

12. The wheel end assembly (10) of claim 11 wherein the compression ring (210) further comprises a second perimeter surface (234) that extends from the second end surface (220) toward the hub (22) and a second outer connecting surface (238) that extends from second perimeter surface (234) to the outer surface (232), preferably the second end surface (220), second perimeter surface (234), and the second outer connecting surface (238) are received in the opening (82).

13. The wheel end assembly (10) of any one of claims 7, 10 or 11 wherein the first end surface (218) extends radially outward past the hub (22).

14. A method for assembling a wheel end assembly (10) according to claim 1, the method comprising:

heating a compression ring (32, 210) to expand the compression ring (32, 210);
positioning the compression ring (32, 210) with respect to a hub (22) such that the hub (22) is received in the compression ring (32, 210); and
cooling the compression ring (32, 210) so that the compression ring (32, 210) exerts a radially inward force on the hub (22).

15. The method of claim 14 further comprising providing a seal assembly (30) that has an outer seal case (36b) and an inner seal case (36a) and assembling

the hub (22) to a spindle (42) such that the outer seal case (36b) is disposed on the hub (22) opposite the compression ring (32, 210) and the inner seal case (36a) is disposed on the spindle (42), preferably the compression ring (32, 210) exerts a radial compressive force on the hub (22) in a direction that extends toward the seal assembly (30) to inhibit the outer seal case (36b) from moving with respect to the hub (22).

Patentansprüche

1. Radendanordnung (10), Folgendes umfassend:

einen Achsschenkel (20), der einen Zapfen (42) und eine Öffnung (82), die sich um den Zapfen (42) erstreckt, aufweist;
eine Nabe (22), die in Bezug zum Zapfen (42) um eine Achse (80) drehbar ist;
eine Dichtungsanordnung (30), die sich vom Zapfen (42) zur Nabe (22) erstreckt, wobei die Dichtungsanordnung (30) ein äußeres Dichtungsgehäuse (36b), das auf der Nabe (22) angeordnet ist, und ein inneres Dichtungsgehäuse (36a), das auf dem Zapfen (42) angeordnet ist, aufweist; **dadurch gekennzeichnet, dass** die Dichtungsanordnung (30) zumindest teilweise in der Öffnung (82) angeordnet ist; einen Kompressionsring (32, 210), der auf der Nabe (22) angeordnet ist und der zumindest teilweise in der Öffnung (82) angeordnet ist, wobei der Kompressionsring (32, 210) in eine Richtung, die sich zur Dichtungsanordnung (30) und der Achse (80) erstreckt, eine radiale Kompressionskraft auf die Nabe (22) ausübt, um zu verhindern, dass sich das äußere Dichtungsgehäuse (36b) in Bezug zu Nabe (22) bewegt.

2. Radendanordnung (10) nach Anspruch 1, wobei die Nabe (22) einen Montagering (130) aufweist, auf dem die Dichtungsanordnung (30) und der Kompressionsring (32, 210) angeordnet sind, wobei der Kompressionsring (32, 210) die Ausdehnung des Montagerings (130) von der Achse (80) weg in Bezug zum Zapfen (42) hemmt, um eine Presspassung zwischen dem äußeren Dichtungsgehäuse (36b) und dem Montagering (130) zu erhalten, wobei der Kompressionsring (32, 210) und das äußere Dichtungsgehäuse (36b) vorzugsweise auf gegenüberliegenden Seiten des Montagerings (130) angeordnet sind.

3. Radendanordnung (10) nach einem der vorstehenden Ansprüche, wobei die Nabe (22) einen volumetrischen Wärmeausdehnungskoeffizienten aufweist, der größer als der volumetrische Wärmeausdehnungskoeffizient des Kompressionsrings (32, 210) ist.

4. Radendanordnung (10) nach einem der vorstehenden Ansprüche, wobei der Kompressionsring (32) eine Innenfläche (192), die mit der Nabe (22) in Eingriff angeordnet ist, und eine Außenfläche (194), die gegenüber der Innenfläche (192) angeordnet ist und sich parallel zur Innenfläche (192) erstreckt, aufweist, wobei sich die Außenfläche (194) von einem ersten Ende des Kompressionsrings (32), das in die Nabe (22) eingreift, zu einem zweiten Ende des Kompressionsrings (32), das gegenüber dem ersten Ende angeordnet ist, erstreckt.

5. Radendanordnung (10) nach Anspruch 4, wobei die Außenfläche (194) in einer Ebene, in der die Achse (80) vollständig angeordnet ist, einen im Wesentlichen ebenen Querschnitt aufweist.

6. Radendanordnung (10) nach Anspruch 4 oder Anspruch 5, wobei der Kompressionsring (32) eine erste Verbindungsfläche (200) enthält, die sich von einem ersten Ende der Innenfläche (192) zur Außenfläche (194) erstreckt, wobei die erste Verbindungsfläche (200) einen im Wesentlichen ebenen Querschnitt in der Ebene aufweist und sich in Bezug zur Innenfläche (192) in einem schrägen Winkel erstreckt.

7. Radendanordnung (10) nach Anspruch 6, wobei der Kompressionsring (32) eine erste Endfläche (202) enthält, die sich von einem Ende der ersten Verbindungsfläche (200) zur Außenfläche (194) erstreckt, wobei die erste Endfläche (202) in die Nabe (22) eingreift.

8. Radendanordnung (10) nach Anspruch 6 oder Anspruch 7, wobei der Kompressionsring (32) eine zweite Verbindungsfläche (200) enthält, die sich von einem zweiten Ende der Innenfläche (192) zur Außenfläche (194) erstreckt, wobei die zweite Verbindungsfläche (200) einen im Wesentlichen ebenen Querschnitt in der Ebene aufweist und sich in Bezug zur Innenfläche (192) in einem schrägen Winkel erstreckt, wobei der Kompressionsring (32) vorzugsweise eine zweite Endfläche (202) enthält, die sich von einem Ende der zweiten Verbindungsfläche (200) zur Außenfläche (194) erstreckt, wobei die zweite Endfläche (202) in der Öffnung (82) angeordnet ist.

9. Radendanordnung (10) nach Anspruch 1, wobei der Kompressionsring (210) eine Innenfläche (214), die mit der Nabe (22) in Eingriff angeordnet ist, eine Außenfläche (232), die gegenüber der Innenfläche (214) angeordnet ist und sich parallel zur Innenfläche (214) erstreckt, eine innere Verbindungsfläche (222), die sich von einem ersten Ende der Innenflä-

che (214) erstreckt, und eine erste äußere Verbindungsfläche (236), die sich von einem Ende der Außenfläche (232) zur Nabe (22) erstreckt, aufweist, wobei die innere Verbindungsfläche (222) im Wesentlichen parallel zur ersten äußeren Verbindungsfläche (236) angeordnet ist.

10. Radendanordnung (10) nach Anspruch 9, wobei der Kompressionsring (210) ferner eine erste Endfläche (218), die sich von einem Ende der inneren Verbindungsfläche (222) erstreckt und in die Nabe (22) eingreift, und eine erste Umfangsfläche (230), die sich von der ersten Endfläche (218) zur ersten äußeren Verbindungsfläche (236) erstreckt, umfasst, wobei die erste Umfangsfläche (230) vorzugsweise im Wesentlichen parallel zur Innenfläche (214) angeordnet ist.

11. Radendanordnung (10) nach Anspruch 10, wobei der Kompressionsring (210) ferner eine zweite Endfläche (220) umfasst, die sich von einem zweiten Ende der Innenfläche (214) erstreckt, wobei die erste Endfläche (218) eine größere radiale Länge als die zweite Endfläche (220) aufweist.

12. Radendanordnung (10) nach Anspruch 11, wobei der Kompressionsring (210) ferner eine zweite Umfangsfläche (234), die sich von der zweiten Endfläche (220) zur Nabe (22) erstreckt, und eine zweite äußere Verbindungsfläche (238), die sich von der zweiten Umfangsfläche (234) zur Außenfläche (232) erstreckt, umfasst, wobei die zweite Endfläche (220), die zweite Umfangsfläche (234) und die zweite äußere Verbindungsfläche (238) vorzugsweise in der Öffnung (82) aufgenommen werden.

13. Radendanordnung (10) nach einem der Ansprüche 7, 10 oder 11, wobei sich die erste Endfläche (218) an der Nabe (22) vorbei radial nach außen erstreckt.

14. Verfahren zur Montage einer Radendanordnung (10) nach Anspruch 1, wobei das Verfahren Folgendes umfasst:

Erwärmen eines Kompressionsrings (32, 210), um den Kompressionsring (32, 210) auszudehnen;
Positionieren des Kompressionsrings (32, 210) in Bezug zu einer Nabe (22), sodass die Nabe (22) im Kompressionsring (32, 210) aufgenommen wird; und
Abkühlen des Kompressionsrings (32, 210), sodass der Kompressionsring (32, 210) eine nach innen gerichtete Radialkraft auf die Nabe (22) ausübt.

15. Verfahren nach Anspruch 14, ferner das Vorsehen einer Dichtungsanordnung (30), die ein äußeres Dichtungsgehäuse (36b) und ein inneres Dichtungsgehäuse (36a) aufweist, und das Montieren der Nabe (22) an einem Zapfen (42), sodass das äußere Dichtungsgehäuse (36b) gegenüber dem Kompressionsring (32, 210) auf der Nabe (22) angeordnet ist und das innere Dichtungsgehäuse (36a) auf dem Zapfen (42) angeordnet ist, umfassend, wobei der Kompressionsring (32, 210) vorzugsweise in einer Richtung, die sich zur Dichtungsanordnung (30) erstreckt, eine radiale Kompressionskraft auf die Nabe (22) ausübt, um zu verhindern, dass sich das äußere Dichtungsgehäuse (36b) in Bezug zur Nabe (22) bewegt.

Revendications

1. Ensemble d'extrémité de roue (10) comprenant:

une articulation de direction (20) ayant une broche (42) et une ouverture (82) qui s'étend autour de la broche (42);
un moyeu (22) qui peut tourner autour d'un axe (80) par rapport à la broche (42);
un ensemble d'étanchéité (30) qui s'étend de la broche (42) au moyeu (22), l'ensemble d'étanchéité (30) ayant un boîtier d'étanchéité externe (36b) qui est disposé sur le moyeu (22) et un boîtier d'étanchéité interne (36a) qui est disposé sur la broche (42);
caractérisé en ce que l'ensemble d'étanchéité (30) est disposé au moins partiellement dans l'ouverture (82) ;
une bague de compression (32, 210) qui est disposée sur le moyeu (22) et qui est disposée au moins partiellement dans l'ouverture (82), la bague de compression (32, 210) exerçant une force de compression radiale sur le moyeu (22) dans une direction qui s'étend vers l'ensemble d'étanchéité (30) et l'axe (80) pour empêcher le boîtier d'étanchéité externe (36b) de se déplacer par rapport au moyeu (22).

2. Ensemble d'extrémité de roue (10) selon la revendication 1, dans lequel le moyeu (22) comporte une bague de montage (130) sur laquelle sont disposés l'ensemble d'étanchéité (30) et la bague de compression (32, 210), la bague de compression (32, 210) empêchant la bague de montage (130) de se dilater en s'éloignant de l'axe (80), par rapport à la broche (42), de manière à maintenir un ajustement serré entre le boîtier d'étanchéité externe (36b) et la bague de montage (130), de préférence la bague de compression (32, 210) et le boîtier d'étanchéité externe (36b) étant placés sur les côtés opposés de la bague de montage (130).

3. Ensemble d'extrémité de roue (10) selon l'une quel-

conque des revendications précédentes dans lequel le moyeu (22) a un coefficient de dilatation thermique volumétrique supérieur à un coefficient de dilatation thermique volumétrique de la bague de compression (32, 210).

4. Ensemble d'extrémité de roue (10) selon l'une quelconque des revendications précédentes, dans lequel la bague de compression (32) a une surface intérieure (192) disposée en prise avec le moyeu (22) et une surface extérieure (194) qui est disposée en face de la surface intérieure (192) et qui s'étend parallèlement à la surface intérieure (192), la surface extérieure (194) s'étendant d'une première extrémité de la bague de compression (32) qui vient en prise avec le moyeu (22) vers une seconde extrémité de la bague de compression (32) qui est disposée en face de la première extrémité.

5. Ensemble d'extrémité de roue (10) selon la revendication 4, dans lequel la surface extérieure (194) a une section transversale sensiblement plane dans un plan dans lequel l'axe (80) est complètement disposé.

6. Ensemble d'extrémité de roue (10) selon la revendication 4 ou la revendication 5, dans lequel la bague de compression (32) comprend une première surface de liaison (200) qui s'étend depuis une première extrémité de la surface intérieure (192) vers la surface extérieure (194), dans lequel la première surface de liaison (200) a une section transversale sensiblement plane dans le plan et s'étend selon un angle oblique relativement à la surface intérieure (192).

7. Ensemble d'extrémité de roue (10) selon la revendication 6, dans lequel la bague de compression (32) comprend une première surface d'extrémité (202) qui s'étend d'une extrémité de la première surface de liaison (200) à la surface extérieure (194), dans lequel la première surface d'extrémité (202) vient en prise avec le moyeu (22).

8. Ensemble d'extrémité de roue (10) selon la revendication 6 ou la revendication 7, dans lequel la bague de compression (32) comprend une seconde surface de liaison (200) qui s'étend depuis une seconde extrémité de la surface intérieure (192) vers la surface extérieure (194), dans lequel la seconde surface de liaison (200) a une section transversale sensiblement plane dans le plan et s'étend selon un angle oblique relativement à la surface intérieure (192), de préférence la bague de compression (32) comprend une seconde surface d'extrémité (202) qui s'étend d'une extrémité de la seconde surface de liaison (200) à la surface extérieure (194), la seconde surface d'extrémité (202) étant disposée dans l'ouverture (82).

9. Ensemble d'extrémité de roue (10) selon la revendication 1, dans lequel la bague de compression (210) présente une surface intérieure (214) disposée en prise avec le moyeu (22), une surface extérieure (232) qui est disposée en face de la surface intérieure (214) et qui s'étend parallèlement à la surface intérieure (214), une surface de liaison intérieure (222) qui s'étend depuis une première extrémité de la surface intérieure (214), et une première surface de liaison extérieure (236) qui s'étend depuis une extrémité de la surface extérieure (232) vers le moyeu (22), la surface de liaison intérieure (222) étant disposée sensiblement parallèlement à la première surface de liaison extérieure (236).

10. Ensemble d'extrémité de roue (10) selon la revendication 9, dans lequel la bague de compression (210) comprend en outre une première surface d'extrémité (218) qui s'étend à partir d'une extrémité de la surface de liaison intérieure (222) et vient en prise avec le moyeu (22) et une première surface périphérique (230) qui s'étend de la première surface d'extrémité (218) à la première surface de liaison extérieure (236), de préférence la première surface périphérique (230) est disposée sensiblement parallèlement à la surface intérieure (214).

11. Ensemble d'extrémité de roue (10) selon la revendication 10, dans lequel la bague de compression (210) comprend en outre une seconde surface d'extrémité (220) qui s'étend depuis une seconde extrémité de la surface intérieure (214), dans lequel la première surface d'extrémité (218) a une longueur radiale supérieure à la seconde surface d'extrémité (220).

12. Ensemble d'extrémité de roue (10) selon la revendication 11, dans lequel la bague de compression (210) comprend en outre une seconde surface périphérique (234) qui s'étend de la seconde surface d'extrémité (220) vers le moyeu (22) et une seconde surface de liaison extérieure (238) qui s'étend de la seconde surface périphérique (234) à la surface extérieure (232), de préférence la seconde surface d'extrémité (220), la seconde surface périphérique (234) et la seconde surface de liaison extérieure (238) étant reçues dans l'ouverture (82).

13. Ensemble d'extrémité de roue (10) selon l'une quelconque des revendications 7, 10 ou 11, dans lequel la première surface d'extrémité (218) s'étend radialement vers l'extérieur au-delà du moyeu (22).

14. Procédé d'assemblage d'un ensemble d'extrémité de roue (10) selon la revendication 1, le procédé consistant à:

chauffer une bague de compression (32, 210)

pour dilater la bague de compression (32, 210);
positionner la bague de compression (32, 210) par rapport à un moyeu (22) de telle sorte que le moyeu (22) soit reçu dans la bague de compression (32, 210); et
refroidir la bague de compression (32, 210) de sorte que la bague de compression (32, 210) exerce une force radialement vers l'intérieur sur le moyeu (22).

15. Procédé selon la revendication 14 consistant en outre à fournir un ensemble d'étanchéité (30) qui comporte un boîtier d'étanchéité externe (36b) et un boîtier d'étanchéité interne (36a) et à assembler le moyeu (22) à une broche (42) de sorte que le boîtier d'étanchéité externe (36b) est disposé sur le moyeu (22) en face de la bague de compression (32, 210) et le boîtier d'étanchéité interne (36a) est disposé sur l'axe (42), de préférence la bague de compression (32, 210) exerce une force de compression radiale sur le moyeu (22) dans une direction qui s'étend vers l'ensemble d'étanchéité (30) pour empêcher le boîtier d'étanchéité externe (36b) de se déplacer par rapport au moyeu (22).

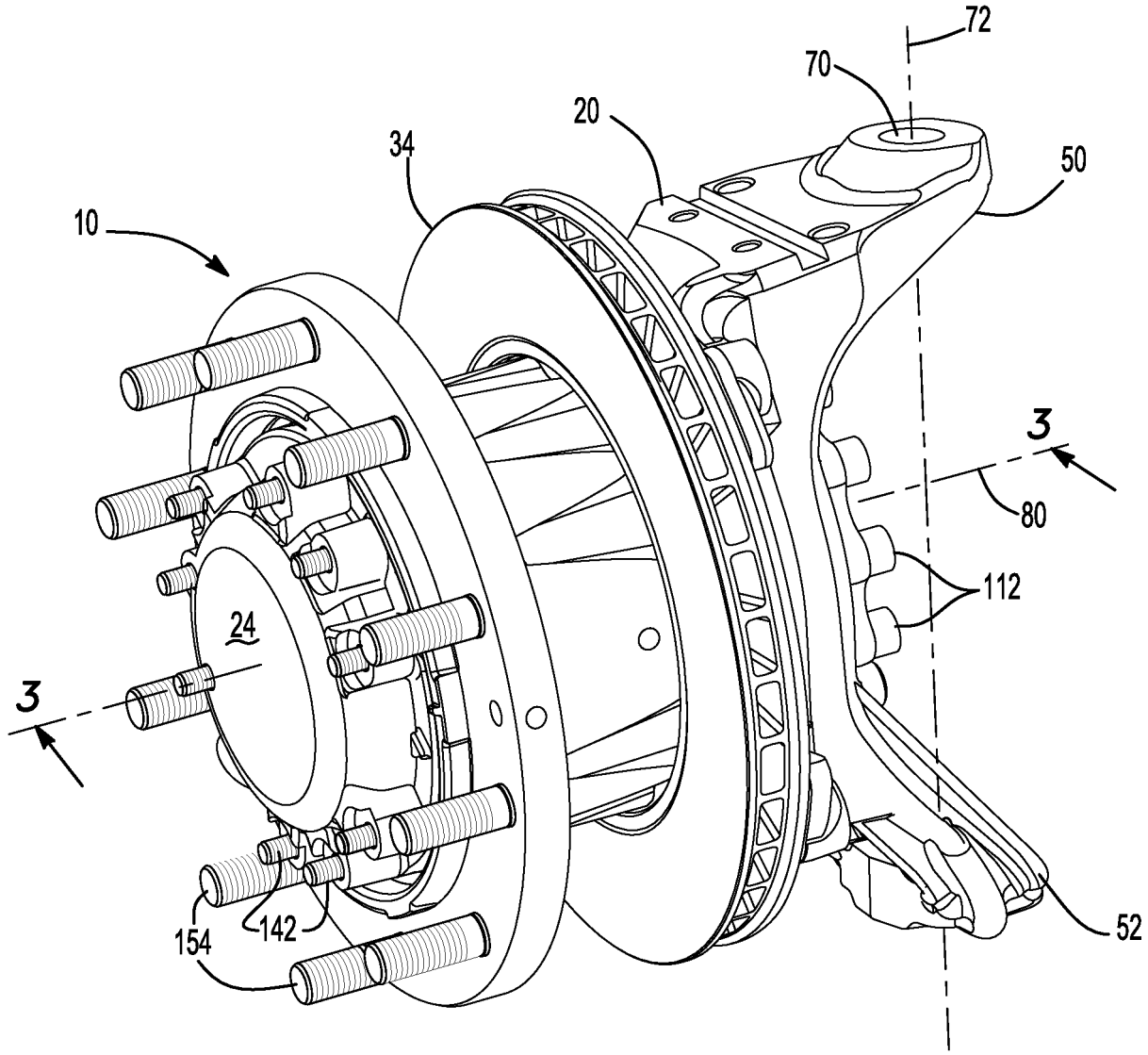
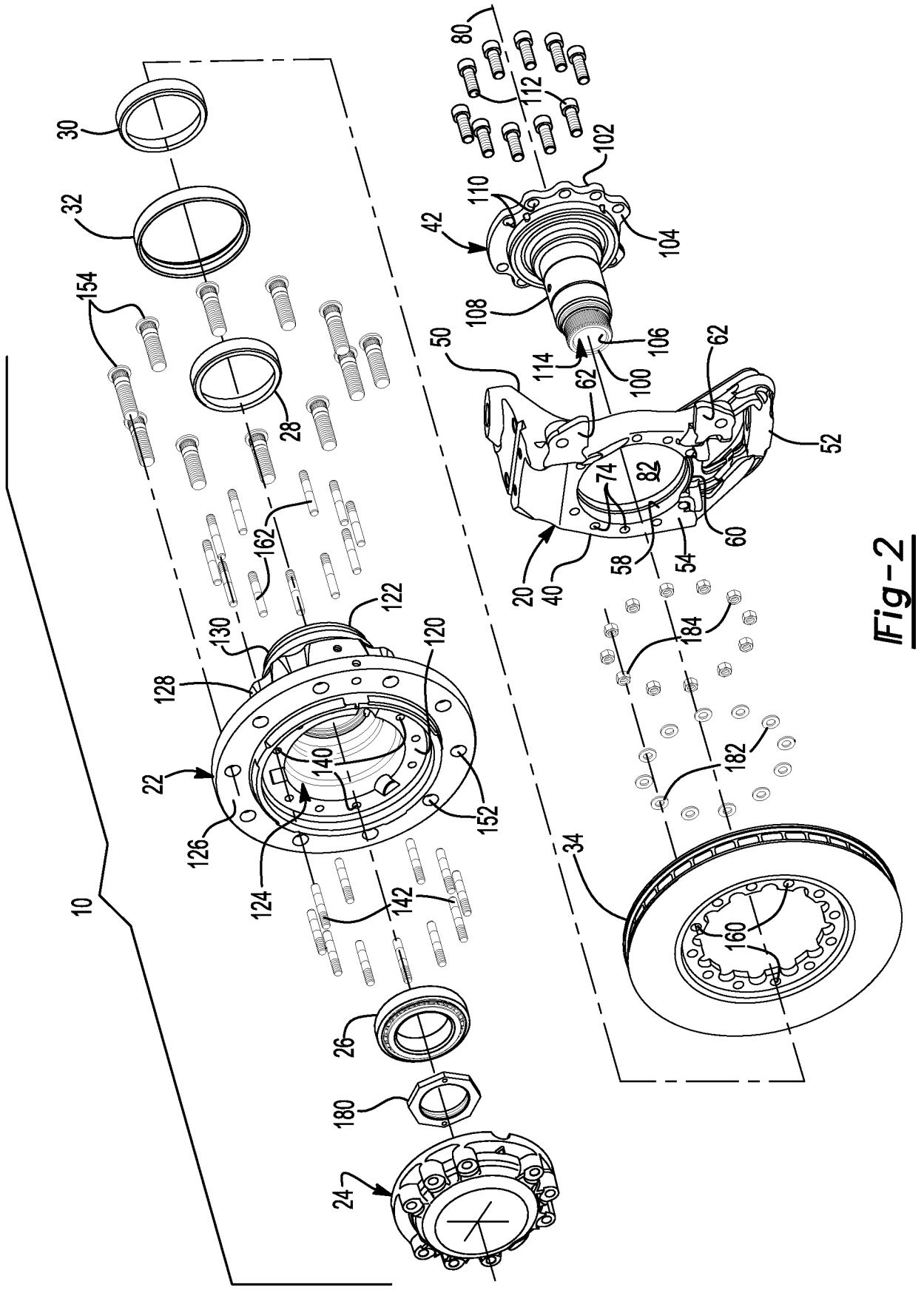


Fig-1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42
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82
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106
108
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128
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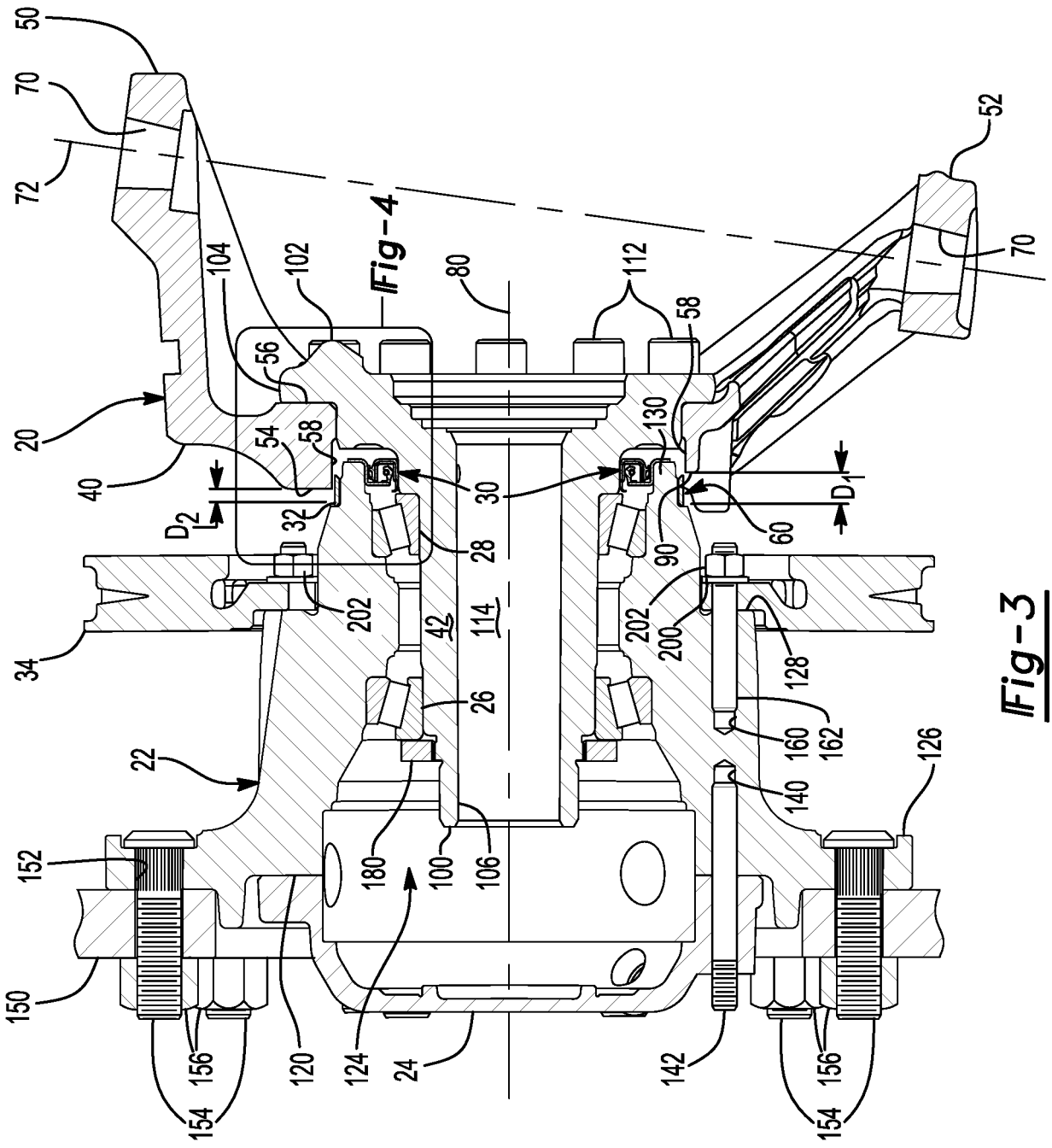
152
154
160
162
180
182
184

Fig-2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30
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90
D_2
D_1
32
28
34
202
42
114
202
200
128
26
160
162
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22
140
152
180
100
106
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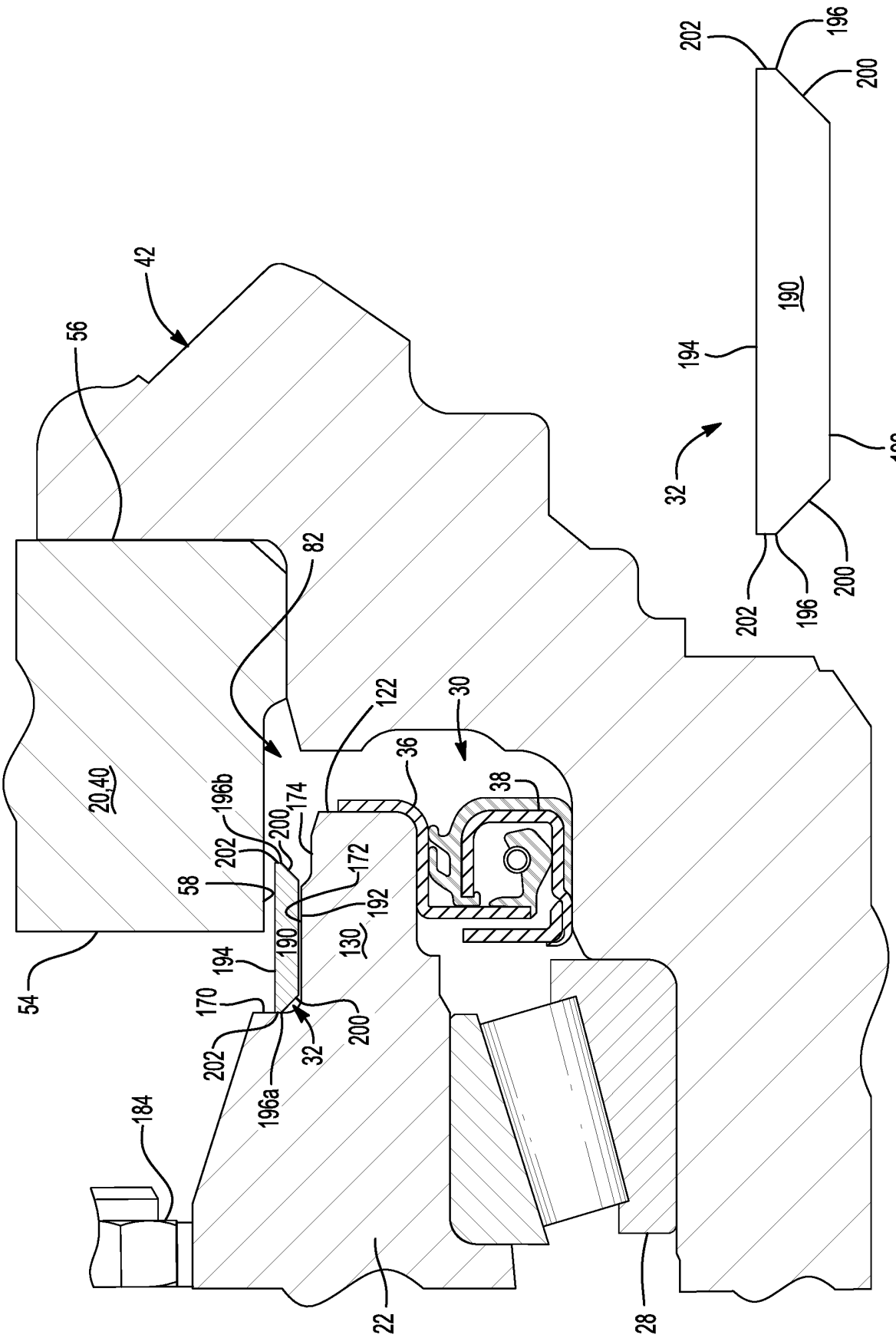
156
120
124
24
142
156
154
154

Fig-4

Fig-3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56
82
122
30
36
38
20,40
196b
174
200
202
172
58
192
190
130
194
170
54
202
196a
32
200
184
22
28

Fig-4

202
196
200
190
194
192
32
202
196
200

Fig-5

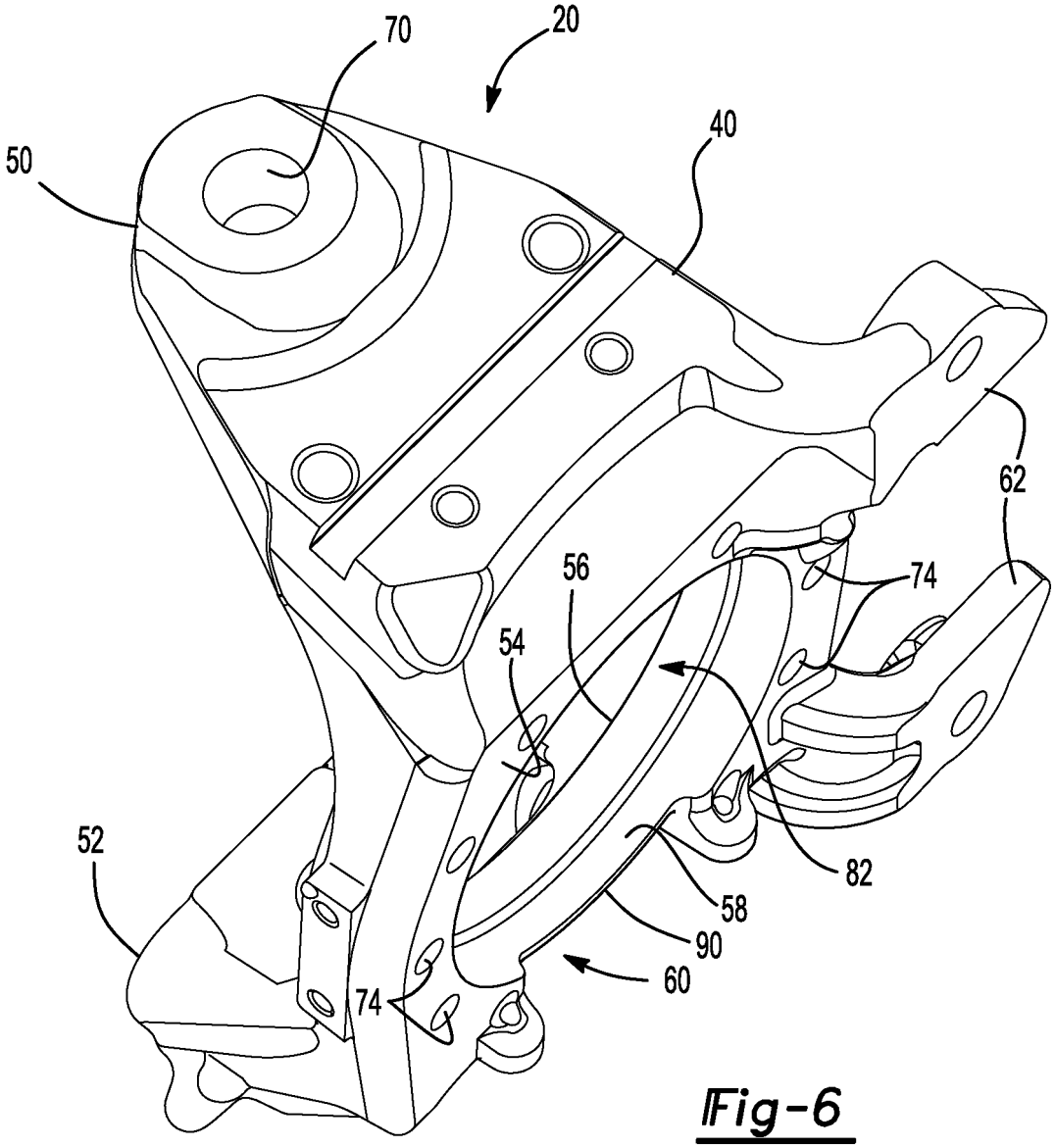
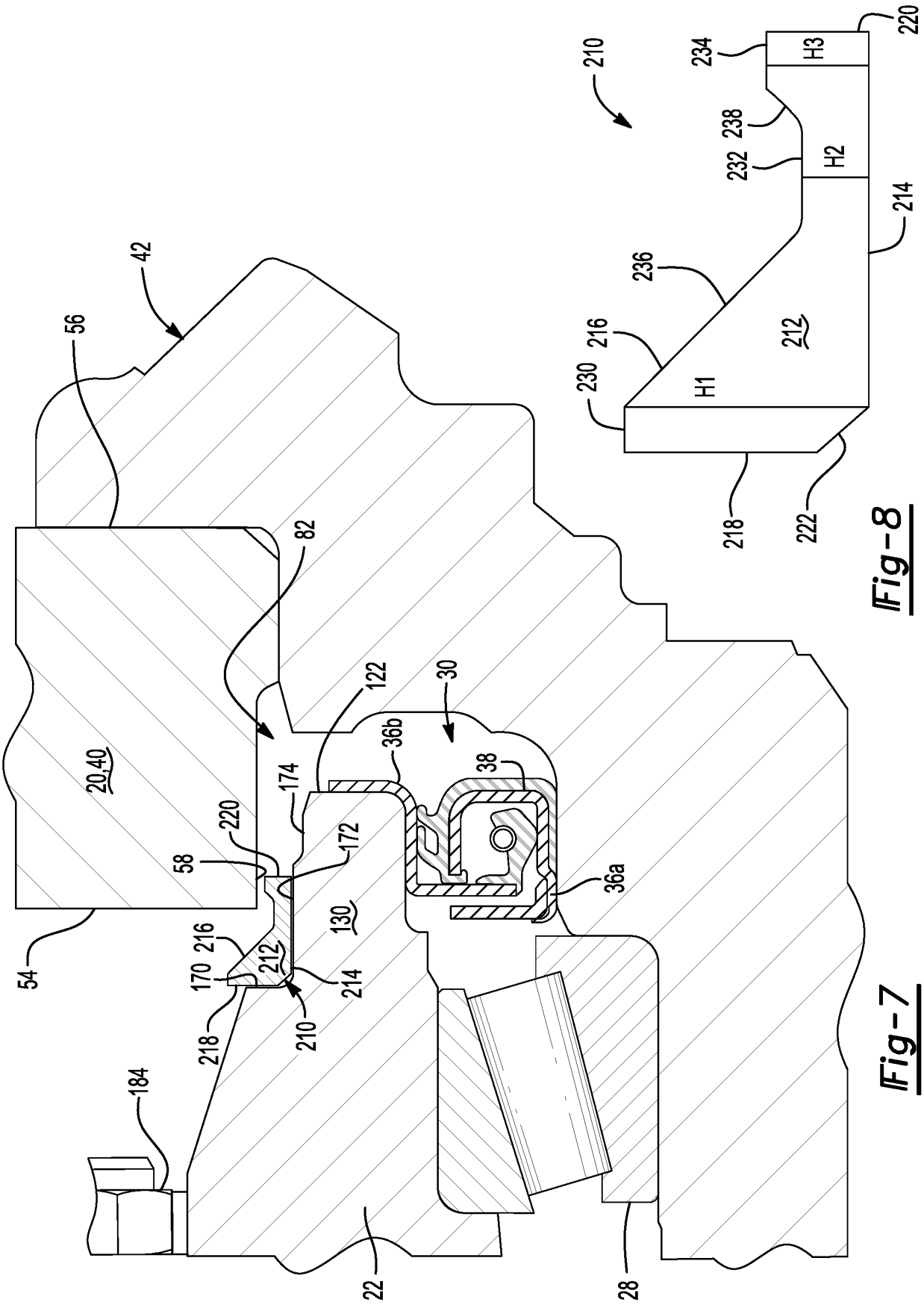


Fig-6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30
36b
38
20,40
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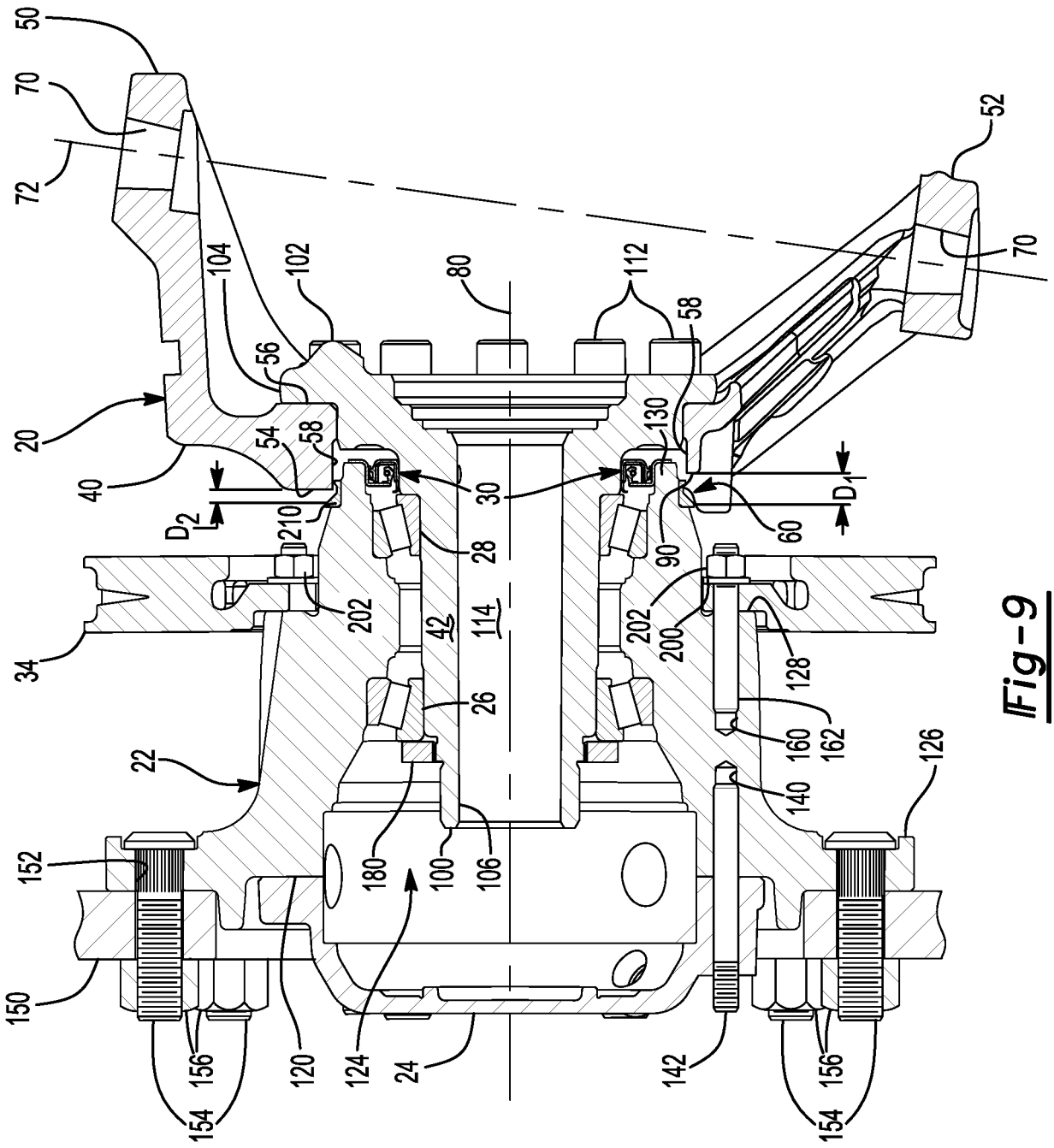
220
58
172
36a
130
54
216
212
170
214
218
210
184
22
28

Fig-7

210
234
H3
220
238
232
H2
214
236
216
212
230
H1
218
222

Fig-8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D_2
D_1
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202
42
114
202
200
128
26
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162
126
22
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152
180
100
106
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142
156
154
154

Fig-9

REFERENCES CITED IN THE DESCRIPTION

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